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EFFECTS OF PARENTAL AGE ON THE FECUNDITY, FERTILITY AND LONGEVITY OF THE MEDITERRANEAN FRUIT FLY, *CERATITIS CAPITATA* WIED.

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EFFECTS OF PARENTAL AGE ON THE FECUNDITY, FERTILITY AND LONGEVITY OF THE MEDITERRANEAN FRUIT FLY, *CERATITIS CAPITATA* WIED.

EFFETTI DELL'ETÀ PARENTALE SULLA FECONDITÀ E LONGEVITÀ DELLA MOSCA MEDITERRANEA DELLA FRUTTA *CERATITIS CAPITATA* WIED.

ABSTRACT

Investigations with single pair mating have been conducted in order to study the influence of parental age on the adult progeny's longevity and reproductive parameters of the Mediterranean fruit fly, *Ceratitis capitata* Wied.

INTRODUCTION

There are a lot of important studies on the relationship between reproductive activity and aging in fruit flies species that usually point out a significant decrease in the fecundity and fertility rates as the adult age increases. However, a lack of extensive works is observed about the influence of parental age on the parameters definning the adult offspring reproduction along their life. As Tsiropoulos pointed out, it seems that parental age affects the physiology, morphology, sex ratio, behavior and other biological characters of the offspring (Tsiropoulos, 1985).

In a former study with the Mediterranean fruit fly, it was concluded that weights of pupae obtained from crosses between old males and females were significantly higher than the ones estimated from the younger ones, irrespective of the pupal age and the larval density, except when the quantity of protein (*Hansenula anomala*) in the larval diet was reduced from 7% to 2% by weight (Muniz and Gil, 1984).

This work has been conducted to study the effect of parental age on the reproductive parameters (fecundity, fertility and longevity) of the adult offspring of the Mediterranean fruit fly, *Ceratitis capitata* Wied., which is reared in our laboratory for bioecological investigations on this species (Andrés and Muniz, 1984; Muniz and Andrés, 1983).

MATERIAL AND METHODS

The parental population was kept in a standard 30-cm-cube cage; adult food was consisted of a mixture 1:3 of yeast hydrolysate and sugar. Eggs collected from parents 5, 15, 21 and 27 day-old were transferred to a Petri dish, in the bottom of which was placed a filter paper moistened with distilled water in order to maintain an optimal level of moisture for incubation. Then, 80 neonata larvae were introduced in vials (2 cm dia. x 9 cm long) containing 5 g of a new larval diet that includes *Hansenula anomala* as protein source (Muniz and Andrés, 1983; Andrés and Muniz, 1984).

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Adults obtained from pupae coming from those larvae were introduced in specially designed oviposition cages at the rate of one single pair mating per cage in order to study different reproductive parameters of this species (MUNIZ, 1984).

Three different functions (polygonal, polynomial and power-exponential) were fitted to the experimental fecundity and fertility data to analyze their daily variation along the female's life span.

Statistical analysis were carried out for the differences between two reproductive parameters. Means followed by the same letter are not different by the Student's t-test at the 0.05 level.

Conditions during the experiments were 26 ± 1°C, 65 ± 5% RH, and 12:12 hrs, L:D regime (1.900 lux.).

RESULTS AND DISCUSSION

The fecundity patterns are presented in tab. I. All populations did not differ significantly in the preoviposition period and daily eggs per female. However, a tendency to increase the total fecundity of females originated from old parents was observed, as well as a higher daily fecundity in females from 21 and 27 day old parents. So, with respect to the total number of eggs, females coming from the oldest parents (27 day-old), laid more eggs than those from 5 and 15 day old parents.

TABLE 1 - *Fecundity of the Mediterranean fruit fly,* Ceratitis capitata *Wied.* ($\bar{x}$ ± S.E.)

Parental age (days)	Preoviposition period (days)	Oviposition period (days)	Total eggs per female	Daily eggs per female
5	3.22 ± 0.05 a (n = 18)	25.78 ± 1.67 a (n = 18)	1622 ± 130 a (n = 18)	44.90 ± 4.50 a (n = 39)
15	3.00 ± 0.00 a (n = 17)	26.71 ± 1.50 a (n = 17)	1701 ± 95 a (n = 17)	43.87 ± 5.09 a (n = 41)
21	3.06 ± 0.24 a (n = 18)	25.39 ± 1.91 a (n = 18)	1731 ± 143 ab (n = 18)	54.68 ± 4.69 a (n = 37)
27	3.27 ± 0.15 a (n = 15)	32.93 ± 1.37 b (n = 15)	1980 ± 56 b (n = 15)	52.65 ± 4.98 a (n = 38)

The power-exponential function was the most appropriate to explain the variation of the estimated fecundity rate along the oviposition period. In the fig. 1 appears this fact for the four populations; different parameters, as well as χ^2, r^2 and freedom degrees (fd) are expressed in table II.

Similar effects were obtained for the fertility, whose results are showed in tables III, IV and fig. 2. For all parameters, females originated from the oldest parents produced significantly more larvae than those from younger parents.

On the other hand, both male and female offspring from the oldest parents lived significantly longer than those from young and middle-aged parents. In all cases, males showed a greater longevity than females (Tab. V).

These results contrast with those obtained by Tsiropoulos with *Dacus oleae*

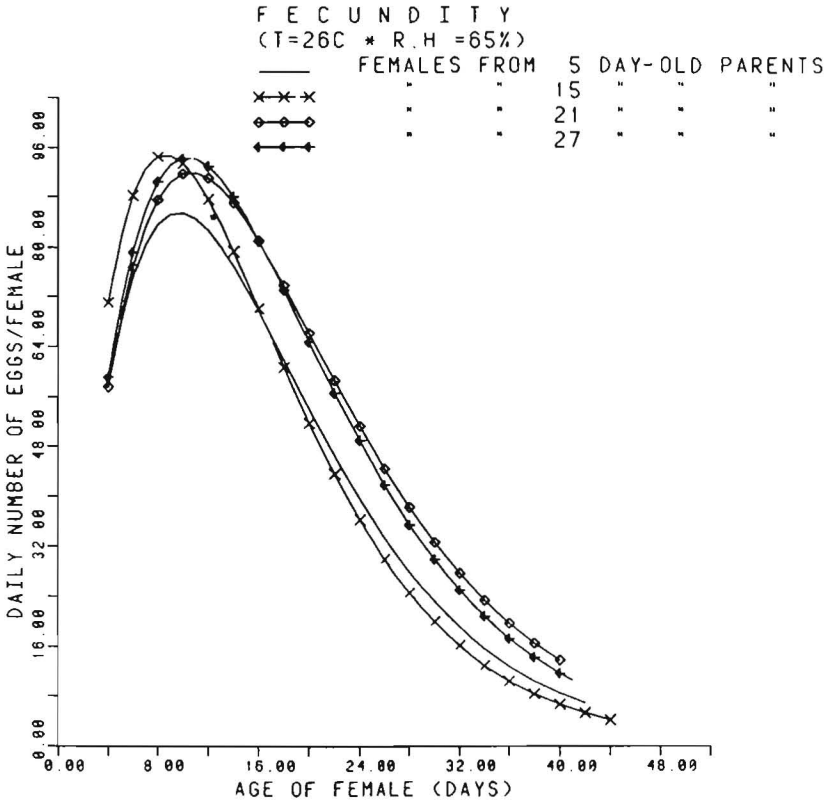

Fig. 1 - Estimated daily oviposition of *Ceratitis capitata* Wied. using the power-exponential function.

Gmel., who found a significant decreasing in the adult progeny's fecundity rate (Tsiropoulos, 1984).

According to the findings of this work, the reproductive activity of adults coming from old parents is better than the one obtained with those originated from the younger parents. So, it is necessary to increase this kind of research in order to acquire a better knowledge of the tails of populations to get reliable

Table 2 - *Parameters of the power-exponential function* $Y = Ae^{B\times}$, x^C *for different populations of* Ceratitis capitata *Wied.*, fitted with the daily fecundity rate, expressed as average of number of eggs per female. (***, significant at the 0.001 level).

Parental age (days)	A	B	C	χ^2	r^2	FD
5	15.56615	—0.139068	1.342992	12.323	0.984***	38
15	22.35488	—0.146128	1.255041	7.790	0.985***	40
21	15.15442	—0.124244	1.321039	23.973	0.959***	36
27	14.76531	—0.133572	1.384749	26.701	0.975***	37

TABLE 3 - *Fertility of the Mediterranean fruit fly,* Ceratitis capitata *Wied.* ($\bar{x}$ ± S.E.)

Parental age (days)	Fertility period (days)	Total larvae per female	Egg hatch (%)	Daily larvae per female
5	27.17 ± 1.63 a (n = 18)	981 ± 95 a (n = 18)	61.94 ± 4.82 a (n = 18)	26.54 ± 3.73 a (n = 39)
15	23.71 ± 1.59 a (n = 17)	1193 ± 84 a (n = 17)	71.30 ± 4.33 a (n = 17)	29.28 ± 4.26 a (n = 41)
21	22.94 ± 1.81 a (n = 18)	1083 ± 103 a (n = 18)	62.93 ± 3.12 a (n = 18)	33.06 ± 4.07 a (n = 37)
27	28.13 ± 1.26 b (n = 15)	1710 ± 56 b (n = 15)	86.34 ± 1.41 b (n = 15)	45.68 ± 5.16 b (n = 38)

TABLE 4 - *Parameters of the power-exponential function* $Y = Ae^{Bx}, x^C$ *for different populations of* Ceratitis capitata *Wied.,* fitted with the daily fertility rate, expressed as average of number of larvae per female. (***, significant at the 0.001 level).

Parental age (days)	A	B	C	χ^2	r^2	FD
5	0.3976350	—0.29588	3.48185	20.627	0.968***	38
15	4.434593	—0.21374	1.214798	21.006	0.963***	40
21	0.26459	—0.26459	1.354419	21.424	0.951***	36
27	1.3928645	—0.17620	2.109581	33.233	0.975***	37

TABLE 5 - *Longevity of the Mediterranean fruit fly,* Ceratitis capitata *Wied.* ($\bar{x}$ ± S.E.)

Parental age (days)	Adult longevity (days) Males		Females
5	49.28 ± 6.23 a	(n = 18)	32.61 ± 1.75 a
15	60.82 ± 6.32 a	(n = 17)	35.88 ± 2.01 a
21	52.11 ± 3.90 a	(n = 18)	31.33 ± 3.04 a
27	87.07 ± 8.00 b	(n = 15)	42.67 ± 1.96 b

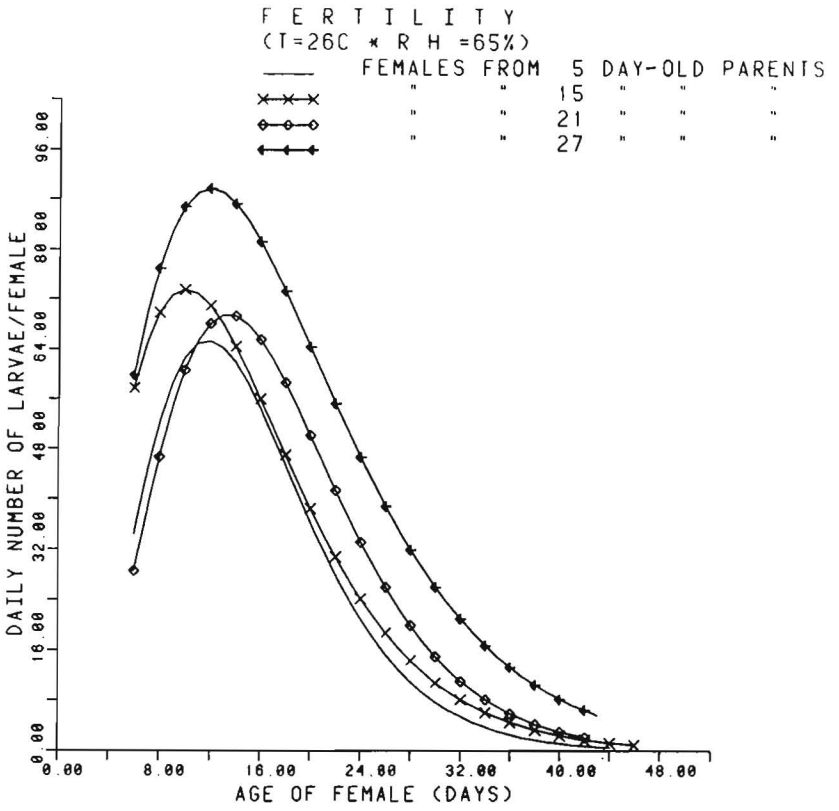

Fig. 2 - Estimated daily fertility of *Ceratitis capitata* Wied. using the power-exponential function.

data on their biological activity and evaluate their incidence in the fruit damage. In this way it will be possible to apply adequate control measures in order to obtain a high degree of efficiency in integrated and biological control programmes.

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SUMMARY

Investigations with single pair matings have been conducted in order to study the influence of parental age on the adult progeny's longevity and reproductive parameters of the Mediterranean fruit fly, *Ceratitis capitata* Wied.

The results obtained with adults whose parents were 5, 15, 21 and 27 day-old showed that, in general, the highest fecundity and fertility levels were observed in females coming from the oldest parents. Males lived significantly more than females and the longevity of males originated from old parents was greater than the one of males offspring from young parents. The considered populations did not differ significantly in the fecundity and fertility periods.

RIASSUNTO

Sono state effettuate osservazioni su coppie singole di *Ceratitis capitata* Wied. per valutare l'influenza dell'età parentale, la longevità e la fecondità della progenie. I risultati ottenuti con adulti provenienti da genitori di 5, 15, 21 e 27 giorni di età, hanno dimostrato che la maggiore fecondità delle femmine è stata registrata in quelle originatesi dai genitori più vecchi.

I maschi vivono più delle femmine e la longevità dei maschi è inoltre maggiore se essi provengono da genitori più vecchi. Le popolazioni considerate non differiscono significativamente in fecondità e fertilità.

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